at least one reflector configured to direct light from the first filter polarization beam displacer to the second filter polarization beam displacer;

a first output polarization beam displacer in optical communication with the birefringent filter assembly; and

a second output polarization beam displacer in optical communication with the first output polarization beam displacer.

REMARKS

This is a response to the initial office action mailed July 2, 2002, in relation to the above-identified patent application. In that initial office action, the examiner rejected claims 1-24 under 35 U.S.C. § 102(b) as being anticipated by Wu, et al.

In this rejection, the Examiner stated that Wu discloses "at least one reflector (elements 106, 107 are at least partially reflective) configured (to) direct light from the first filter polarization beam displacer to the second polarization being displacer (see Fig. 2)."

However, Applicant respectfully submits that elements 106 and 107 are not partially reflective. Rather, element 106 is a polarization rotator which does not reflect any substantial portion of the light instance thereupon and elements 107 are stacked birefringent waveplates which, likewise, do not reflect any substantial portion of the light incident thereupon. Rather, the purpose of the polarization rotator 106 is to rotate the polarization direction of light incident thereupon to an orientation which is appropriate for the stacked birefringent waveplates 107, so that they perform their intended filtering function upon the rotated light beams. Neither of the polarization rotator 106 nor the stacked birefringent waveplates 107 are intended to reflect any light back toward the birefringent element 102 and, indeed, any such reflection is merely parasitic and is detrimental to the interleaving function of the Wu device.

By way of contrast, the reflector(s) recited in claim 1 of the subject patent application provide the beneficial difference in path lengths which facilitate interleaving.

It is also worthwhile to note that the device of the present invention is specifically configured so as to mitigate polarization mode dispersion (PMD), whereas the device of Figure 2 of the Wu et al. reference is not configured so as to mitigate polarization mode dispersion (PMD). Indeed, the difference between the path lengths of the two light components in the Wu, et al. device results in

undesirable polarization mode dispersion (PMD), rather than providing a desired birefringement effect as in the present invention.

In any event, neither the polarization rotator 106, nor the stacked birefringent waveplates 107, are configured to "direct light from the first filter polarization beam displacer to the second polarization beam displacer" as recited independent claim 1 of the subject patent application. Indeed, light reflected from the polarization rotator 106 and/or the stacked birefringent waveplates 107, if any substantial amount of such light exists, is not being directed from one polarization beam displacer to another polarization beam displacer of the Wu device.

By way of contrast, the reflectors 14a and 15a (Fig. 1) of the present invention are specifically configured to direct substantially all of the light from the first filter polarization beam displacer 12a to the second filter polarization beam displacer 13a.

Further, independent claim 1 of the subject patent application recites "an input polarization beam displacer", a birefringent filter assembly comprising "a first filter polarization beam displacer" and "a second filter polarization beam displacer", as well as "a first output polarization beam displacer" and "a second output polarization beam displacer". Thus, claim 1 clearly recites five different polarization beam displacers. However, Figure 2 of the Wu, et al., patent only shows two polarization beam displacers (birefringent element 102 and birefringent element 108).

Moreover, it is important to appreciate that the present invention utilizes a difference in the first and second optical path lengths such as that provided by the difference in positioning of the two mirrors 14a and 15a or such as that "provided by a material having an index of refraction greater than one which is disposed within at least a portion of one of the first and second paths", as recited in dependent claim 20, to achieve a birefringent effect. By way of contrast, the Wu, et al. device utilizes stacked birefringent plates 107. That is, the present invention utilizes a difference in path length cause by reflection and/or the use of a material having an index of a refraction greater than one to facilitate interleaving, whereas the Wu et al. device utilized stacked birefringent plates crystals for this purpose.

Indeed, it is an explicit goal of the present invention to eliminate such stacked birefringent plates. According to the specification of the subject patent application, such birefringent filters "suffer from substantial limitations with respect to channel spacing, dispersion, insertion loss, channel isolation, temperature stability, costs, reliability and flexibility" (paragraph 10) and thus it is a goal of the present invention to "overcome or mitigate at least some of the above-mentioned limitations" (paragraph 11).

Furthermore, the subject patent application states that "According to the present invention birefringent crystals, such as those commonly used in contemporary birefringent filters, are eliminated so as to mitigate at least some of the problems associated with prior art interleavers" (paragraph 13). The specification goes on to state that "Rather than using birefringent crystals, the interleaver of the present invention utilizes a device which provides optical paths having different optical path lengths for two orthogonally polarized light beams so as to provide a birefringent effect" (paragraph 13). Thus, it is clear that the specification of the present invention stresses that birefringent crystal filters, such as the stacked birefringent plates 107 of the Wu patent are not included in the present invention. Moreover, the Wu, et al. device does not use reflection to cause a birefringent phase delay in order to provide its interleaving function.

Further, the Examiner stated that "a first output polarization beam displacer (111)" is disclosed in Figure 2 of the Wu, et al. reference. However, item 111 of the Wu, et al. reference is actually "a vertical component" (column 6, line 24) of the optical signal. Applicant believes that the Examiner is actually referring to the combining element 109, rather than the vertical component 111. The combining element 109 appears to be a reflector, (apparently a prism). Thus, the Wu, et al. device does not appear to disclose "a first output polarization beam displacer" as recited in independent claim 1.

Similarly, the Examiner stated that Figure 2 of the Wu, et al. patent discloses "a second output polarization beam displacer (110)." However, item 110 of the Wu, et al. reference is actually a combining element (column 6, lines 39-40) (apparently a polarization beam splitter comprised of two prisms). Thus, the Wu, et al. patent does not disclose "a second output polarization beam displacer", as recited in independent claim 1.

It is worthwhile to appreciate the present invention differs in basic configuration with respect to the Wu, et al. device. The present invention has a folded or reflection based configuration, wherein light reverses direction during its travel therethrough. By way of contrast, the Wu, et al. device has a straight-through configuration, wherein light doe not reverse direction during its travel therethrough.

In view of the foregoing, it is respectfully submitted that the Wu, et al. reference neither discloses nor makes obvious the combination of "an input polarization beam displacer", "a first filter polarization beam displacer", "a second filter polarization beam displacer", "a first output polarization beam displacer", and "a second output polarization beam displacer", as recited in independent claim 1. Further, the Wu, et al. patent neither discloses nor makes obvious "at least one

reflector configured to direct light from the first filter polarization beam displacer to the second filter polarization beam displacer", as also recited in independent claim 1.

It is respectfully submitted that the dependent claims are independently patentable with respect to the independent claim. For example, dependent claim 5 recites "a material disposed in at least one of the first and second paths, the material having an index of refraction which causes the first and second paths to have different optical path lengths." The Wu, et al. reference neither discloses nor makes obvious the use of such a material in an interleaver which lacks birefringent elements, such as the stacked birefringent waveplates 107 thereof. A similar limitation is recited in dependent claims 20 and 21.

The amendments to the specification and claims have been made to correct minor typographical errors.

In view of the foregoing, it is respectfully submitted that all of the pending claims of the subject patent application are in a condition for immediate allowance. Reconsideration and an early allowance is therefore respectfully requested.

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Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES

IN THE SPECIFICATION

Paragraph 79 has been amended as follows:

[0079] Although examples discussed above utilize equivalent birefringent filter element angles of 45°, -21° and [-]7° and utilize phase delays of Γ, 2Γ and 2Γ, those skilled in the art will appreciate that various other angles and phase delays are likewise suitable. For example, phase delays of Γ, 2Γ and Γ may alternatively be utilized.

IN THE CLAIMS

1. (Amended) An interleaver comprising:

an input polarization beam displacer;

a birefringent filter assembly in optical communication with the input polarization beam displacer, the birefringent filter assembly comprising at least one birefringent filter stage, each birefringent filter stage comprising:

a first filter polarization beam displacer;

a second filter polarization beam displacer;

at least one reflector configured to direct light from the first filter polarization beam displacer to the second filter polarization beam displacer;

a first output polarization beam displacer in optical communication with the birefringent filter assembly; and

a second output polarization beam displacer in optical communication with the first output polarization beam displacer.